2. For the medicine in part (1), Janelle wrote the equation $m = 60(0.8)^h$ to show the amount of active medicine m after h hours. Compare the quantities of active medicine in your table with the quantities given by Janelle's equation. Explain any similarities or differences.

3. Dwayne was confused by the terms **decay rate** and *decay factor*. He said that because the rate of decay is 20%, the decay factor should be 0.2, and the equation should be $m = 60(0.2^h)$. How would you explain to Dwayne why a rate of decay of 20% is equivalent to a decay factor of 0.8?

ACE **Homework starts on page 53.**

4.3 Cooling Water

Sometimes a cup of hot cocoa or tea is too hot to drink at first, so you must wait for it to cool.

What pattern of change would you expect to find in the temperature of a hot drink as time passes?

*What shape would you expect for a graph of (*time, drink temperature*) data?*

This experiment will help you explore these questions.

Equipment:

- very hot water, a thermometer, a cup or mug for hot drinks, and a watch or clock

Directions:

- Record the air temperature.
- Fill the cup with the hot water.
- In a table, record the water temperature and the room temperature in 5-minute intervals throughout your class period.

Hot Water Cooling

Time (min)	Water Temperature	Room Temperature
0	■	■
5	■	■
10	■	■
■	■	■
■	■	■

Problem 4.3 Modeling Exponential Decay

A. **1.** Make a graph of your (*time, water temperature*) data.

2. Describe the pattern of change in the data. When did the water temperature change most rapidly? When did it change most slowly?

B. **1.** Add a column to your table. In this column, record the difference between the water temperature and the air temperature for each time value.

2. Make a graph of the (*time, temperature difference*) data. Compare this graph with the graph you made in Question A.

3. Describe the pattern of change in the (*time, temperature difference*) data. When did the temperature difference change most rapidly? When did it change most slowly?

4. Estimate the decay factor for the relationship between temperature difference and time in this experiment.

5. Find an equation for the (*time, temperature difference*) data. Your equation should allow you to predict the temperature difference at the end of any 5-minute interval.

C. **1.** What do you think the graph of the (*time, temperature difference*) data would look like if you had continued the experiment for several more hours?

2. What factors might affect the rate at which a cup of hot liquid cools?

3. What factors might introduce errors in the data you collect?

D. Compare the two graphs in Questions A and B with the graphs in Problems 4.1 and 4.2. What similarities and differences do you observe?

ACE **Homework starts on page 53.**